DETAILED DESCRIPTION OF THE INVENTION

The present invention utilizes a jelly composed of Low Methoxyl Pectin (LMP) which serves as bait and maintains in a gelatin state for longer periods of time. The jelly is mixed with insecticide and injected with syringe into the hideouts of the cockroaches, such as crevices, corners, holes, kitchen cabinets, etc. where the cockroaches nest or feed. The jelly should especially be applied at the entrances or exits to increase the chances of encounter and of killing, and to serve as a longer lasting bait and insecticide. The jelly can be sprayed deep into the crevices and block the entrance and exit to increase the likelihood of contacting the cockroaches. The bait and the insecticide under the protection of the jelly can be maintained for a longer period of time by avoiding the evaporation of water. The softness of the jelly satisfies the appetite of the cockroaches. In general, the cockroaches finish the entire feed without any leftover. If there is any leftover in the jelly, there is nothing that cannot be easily cleaned off.

The pectin is composed of 300-1000 methylated ester of polygalacturonic acid molecules in a long chain. Commercial pectin is extracted from orange peel or crashed apple under somewhat acidic conditions. According to the definition of Food Chemicals Codex (FCC), if the Methoxyl is more than 50%, the pectin is referred to as High Methooxyle Pectin (HMP); if the Methoxyl is less than 50%, the pectin is referred to as Low Methoxyl Pectin (LMP). Both types of pectin can jellify after dissolved in water at room temperature with different conditions to jellify. HMP requires high solute concentration and low pH to jellify. In contrast to HMP, the LMP jellifies in less stringent conditions, but requires II valence metal such as calcium ion to jellify. In general, the LMP required for jellification lies between 0.6% and 10%, and the pH value lies between 1.0 and 7.0. LMP depends on the carboxyl group in the methylated ester of polygalacturonic acid and II valence metal ion such as calcium ion to form a bridge junction. This bridge junction easily jellifies into irregular shape glue due to losing water in the junction zone. All II valence metallic ions possessing such a property are referred to as Alginates. Their ability to induce jellification is in the order of magnesium ion (Mg^{2+}) << calcium ion (Ca^{2+}); and strontium ion (Sr^{2+}) << barium ion (Ba^{2+}).

The insecticides for the jelly bait include: (1) Boric Acid; (2) organic phosphate: e.g. Chlorpyrifos, Fenietrothion, Fenthion, Malathion, Pirimiphos-Methyl and Temephos; and (3) synthesized Chrysanthemum essence: e.g. Bioresmethrin, Cypermethrin, Deltamethrin, Permethrin, Phenothrin, Resmethrin, S-Bioallethrin, and Tetramethrin.

The following jelly baits are examples using boric acid and Chlorpyrifos as ingredients:

Example I. Using boric acid as principal insecticide:

	Weight % Concentration	Weight % concentration Allowed
Low Methoxyl Pectin, LMP	0.8 %	0.6 % ~ 10%
Food-based Bait	1.0 %	0.5 % ~ 2%
$CaCl_2$	1000ppm	50-3000 ppm
Boric acid	30 %	20% - 60 %
Water	68.2 %	appropriate amount to jellify

Test of cockroach: *Supella longipalpa*

Test of Effectiveness:

A. Equipment: Bait box 25x15x17 cm^3, screened to prevent cockroaches from climbing out.

B. Method:

I. Load 1.5 gram tested jelly bait in a plastic petri dish and place inside the bait box. Also place food and water in the bait box near where cockroaches may hide.

II. Put a cockroach doped with carbon dioxide in the test box and let the cockroach to eat freely for eight consecutive days. The mortality rate is recorded.

C. Results:

Days after feeding	1	2	3	4	5	6	7	8
Death Rate (%)	3.3±5.8	13.3±15.3	30.0±10.0	33.3±5.8	53.3±5.8	70.0±0.0	96.7±5.8	100±0.0

Example II. Using Chlorpyrifos as principal insecticide: The ingredients are as follows:

	Weight % Concentration	Weight % Concentration allowed
Low Methoxyl Pectin, LMP	0.8 %	0.6%~10 %
Food-based Bait	1.0 %	0.5 % ~ 2 %
$CaCl_2$	1000 ppm	50-3000 ppm
Chlorpyrifos	2 %	0.5 % ~ 3 %
Water, H_2O	96.2 %	appropriate amount to jellify

The test method is the same as *Example I.* The results are as follows:

Days after feeding	1	2	3	4	5	6	7	8
Death Rate (%)	43.3±5.8	63.3±5.8	96.7±5.8	100±0.0	XX	XX	XX	XX

The food-based bait used in our tests is water soluble and dissolved easily without affecting jellification after the introduction of $CaCl_2$ into the pectin solution. There are many kinds of food-based bait well known in prior art. The jelly bait of the present invention can contain food baits like onion, milk powder, flour, sugar, meat etc. without affecting ability to jellify. Based on our observation, different kinds of cockroaches such as *Periplaneta Americana*, *Blattella germanica* or *Periplaneta brunnea* do not differ significantly in their preference of bait. They all prefer jelly type baits with high water content. Therefore, the tested results should be applicable to any other kinds of cockroaches.

Boric acid has been known for its low solubility in water and the delayed action as an insecticide. The killing mechanism can be divided into two categories. The first category is to kill by contact and requires over 40% suspended content in the jelly to be effective. The second category is to kill by intake and requires 10-40% suspend content in the jelly. The cockroaches would die one to eight days after intake.

Chlorpyrifos is an organic phosphate. Due to low insect repellent property, it is widely used as a low toxicity insecticide. It is available in the market with 40.8% concentration soluble in water and can be mixed with pectin solution to form milky gel. Such an insecticide has faster action, commonly with 1-2% dosage. Cockroaches usually die in 2-3 days after intake.

Example III. Low methoxyl pectin-amidated, LMPA.

To prepare pectin-mediated jelly bait, the LMP can also be replaced with Low methoxyl pectin-amidated, LMPA, with other ingredients remain unchanged. The LMPA can be obtained through amidated process to the the carboxy group in LMP to become LMPA. The LMPA can also jellify in the presence of II valence metal ion similar to LMP. The advantage over LMP is that the melting point of the jelly is higher up to 150°C, whereas the LMPA jelly would melt at 75°C. At pH value below 3.4, the hardness of the LMPA jelly is higher than that of LMP jelly.

While the preferred embodiments of the art have been described, it will be apparent to those skilled in the art that various modifications can be made in the embodiments without departing from the spirit of the present invention. Such modifications are all within the scope of this invention.